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CUCUMBER DISEASE INVESTIGATIONS ON LONG ISLAND

E. E. CLAYTON



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CUCUMBER DISEASE INVESTIGATIONS ON LONG ISLAND

E. E. CLAYTON

ABSTRACT

The growing of cucumbers on Long Island, once a major industry, has been largely abandoned because of regular heavy losses from diseases. The chief of these diseases is mosaic, tho wilt and mildew or blight are also destructive. The cucumber disease investigations conducted by the Station have included studies of seed treatment, spraying experiments, and attempts to breed disease-resistant varieties.

None of the important cucumber diseases are controlled by seed treatment; but treatment was found of value, when the seed was sown early, in protecting the seed from decay, and thereby insuring a satisfactory stand. Of the treatments tested, dusting with an organic mercurial (Semesan Jr.) was the best. This treatment is recommended for all seed planted before June 1.

Experiments with both wet and dry sprays have shown that thoro protection against the cucumber beetle during the six weeks following sowing will control wilt disease. Dust mixtures, such as calcium arsenate-gypsum, 1 to 15, and also copper-lime, were fairly satisfactory, but the best wilt control was secured by spraying. The best spray mixture was kayso-calcium arsenate, 3-3-50. In addition to controlling wilt, the effect of this spray on plant growth was excellent. The use of bordeaux mixture for these early sprays is likely to cause stunting and is not to be recommended, tho it gives very good wilt control.

Spraying for mildew should begin the last of July. Applications should be made twice a week, the first three with 3-4-50 bordeaux mixture, and later applications with 6-8-50 bordeaux mixture. Spraying does not control mosaic.

The studies show that the only possibility of controlling mosaic disease on Long Island is thru the development of disease-resis-

tant varieties. Inbreeding of the common varieties has produced strains which are distinctly more mosaic-resistant than the parent varieties. Also, strains showing resistance to wilt disease have been secured. Tests with many varieties of cucumbers secured from foreign countries have shown that a few of these are highly mosaic-resistant. The work of combining a high degree of mosaic resistance with a desirable market type is well under way.

INTRODUCTION

Long Island was one of the early pickle-producing centers of the United States and as recently as 15 years ago the growing of cucumbers was a very important industry. Beattie (1)¹ summarizes the ideal growing conditions for the crop as "a fertile, well-drained soil free from disease, a growing season of 120 to 150 days, without extremes of heat and cold, and a moderate, well-distributed supply of moisture." Long Island probably fits these soil and climatic conditions as well as any section in the country. Cucumbers continued to be an important crop in this locality for many years, but, starting about 1910, it became known that the crop did not do well in the older areas at the western end of the Island, and the industry moved east. Soon the new areas were affected and half crops the rule.

At present, only a few hundred acres are grown in several small sections at the extreme eastern end of the Island. There has been no decline in demand for cucumbers, in fact, as the crop grew less, the pickle buyers raised contracts to a figure that, with good crops, would make possible gross returns of \$800 to \$1,000 per acre. The volume of demand is such that at least 10,000 acres should be normally produced on Long Island, and this farming locality is in great need of such a cash crop. The reason for the decline of cucumber growing has been the mosaic or white pickle disease, which, once established in a locality, has reduced yields regularly about 50 per cent. Under such conditions growers have naturally become discouraged, and, after a few years of failure, have given up the crop.

In addition to conducting studies on the control of mosaic disease, the cucumber disease situation on Long Island as a whole has been investigated, for there are other diseases that cause heavy losses, and the growers, to produce safely and economically, need a complete

¹Refers to Literature Cited, page 20.

practical schedule of disease control that covers adequately each serious disease hazard.

THE DISEASES

In view of the present-day seriousness of cucumber diseases, we have been interested to search in the old accounts for mention of these troubles. The cucumber is one of the most ancient of vegetable crops and it was cultivated extensively in the earliest times of which there is record. The Israelites, complaining to Moses of the hardships of the wilderness, said, "We remember the fish which we did eat in Egypt freely—the cucumbers and the melons."

It is recorded (16) that in Syria in very early times the cucumber was cultivated in large fields with a hut in the center of each, where lived the watchman who stood guard over the crop. Evidently there were enemies to be protected against, but of a different sort from those which we must now combat.

Much attention was paid to varieties, which were apparently well fixed. Johnson (11) in 1633 mentions four. In the *Universal Gardener and Botanist* in 1778 Mawe and Abercrombie (13) listed and described such varieties as Early Green Cluster, "A short fruit remarkable for growing in clusters"; Short Green Prickly, a variety bearing fruit 3 to 4 inches long; and Long Green, said to be a long smooth cucumber having early and late strains, and also a white-fruited strain. Two other white-fruited varieties are also described.

Martyn (12), in 1808, gives a very complete account of cucumber varieties and methods of handling, discussing such matters as age of seed, need for pollination, and many other things which apply today equally as well. In none of these, nor in any other of the numerous references consulted, however, was there any mention of disease problems. It is not likely that present-day diseases did not exist, rather it seems probable that they were uncommon because restricted transportation facilities prevented the rapid spread of such troubles from locality to locality, from country to country, or from continent to continent; and, because intensive cultivation of this and other crops over large areas is a development of very modern times. As will be mentioned later, the disastrous epidemics of cucumber mosaic disease on Long Island are closely related to the intensive development of the potato industry in this locality, and hence intensive cultivation of a crop may not only increase disease problems of that crop, but those of other crops as well.

THE MOSAIC DISEASE

So far as can be learned, mosaic has developed as a serious disease within the last 25 years. Our present knowledge of the trouble is the result of careful research by Doolittle (4). The disease is caused by a virus, but the original source of this virus is unknown. The diseased plants are rarely killed outright, but they cease to grow and become stunted and worthless (Fig. 1).



FIG. 1.—CHARACTERISTIC GROWTH OF MOSAIC-INFECTED CUCUMBER PLANT.

The disease symptoms are variable on Long Island. The name mosaic refers to the mottling of the leaves with light and dark green blotches, but, while this is conspicuous in the greenhouse, it has not been a prominent symptom under field conditions. Affected plants always have a "dead" appearance and are evidently unhealthy. Perhaps the most dependable and constant symptom has been the condition of the vine tip. There the leaves are bunched (Fig. 2) due to the shortening of the internodes (the interval between leaves). The fruits borne on mosaic vines are often knobby or blotched, or else a



FIG. 2.—HEALTHY AND MOSAIC-INFECTED TIPS OF CUCUMBER VINE.
The bunching of the leaves at the tip of the vine is the most consistent symptom of mosaic as it occurs on Long Island.

pale yellow white. These latter are the so called white pickles, hence the common name "white pickle disease".

Mosaic attacks several perennial weeds and lives over winter in the roots of these. On Long Island, milk weeds (*Asclepias syriaca*) are sometimes affected and poke weeds (*Phytolacca decandra*) very commonly. Mosaic attacks wild cucumbers and lives over in the seed. In

some localities the diseased wild cucumbers are a common source of the infection in early spring, but this plant is rare on Long Island. The disease does not live over winter in the diseased fields of cultivated cucumbers, since the virus dies soon after the crop dries up. It is not carried over in the seed of cultivated cucumbers.

Mosaic is spread from the wild host plants to the cultivated crop by insects, and it is similarly spread from plant to plant. Pickers and others working in the field also help spread the disease. Of the insects known to transmit mosaic, cucumber beetles are very numerous on Long Island, appearing each spring with great regularity. In some localities these insects are considered to be the primary spreaders of mosaic. They do this by feeding early in the spring on diseased wild cucumbers, and then moving to the cultivated ones as soon as the plants are up. On Long Island, however, there is no connection between the appearance of the beetles and the appearance of the mosaic. This is doubtless due to the fact that there are practically no wild cucumbers, and the beetles do not feed on the other wild host plants.

The melon louse (*Aphis gossypii*) is another carrier of mosaic, but this insect is not so common. The melon louse is occasionally observed on milkweed, but there is no indication that it is the source from which mosaic makes its start in the spring.

The significant sequence that has been observed on Long Island is first, about July 10, the migration of the aphids (*Myzus persicae* and *Macrosiphum solanifolii*) from potatoes. Long Island grows 40,000 acres of potatoes, so these fields are of vast extent, and during the aphid migration the air is filled with flying insects, which, aided by the usually strong breezes, are blown for long distances, and infest cucumbers and many other vegetable crops. The aphids do not remain in the cucumber fields long and cause little damage by their feeding, but each year, about two weeks after the migration, cucumber mosaic disease regularly makes its appearance. The subsequent spread of the disease is very rapid and fields are often 100 per cent infected by August 1. It has been often observed that after the first appearance of the disease a rain, or even a slight shower, has a marked effect; fields with 3 or 4 per cent of visible infection prior to the rain, having 100 per cent infection after it, as evidenced by the dead appearance of the vines. We have never had the slightest difficulty in transmitting cucumber mosaic with either of the two species of aphids mentioned, and this has also been proved by Hoggan (7).

Johnson (10) has shown that the potato is subject to infection by

cucumber mosaic virus, and in one test out of a number of such attempts we were able to secure cucumber mosaic infection from aphids naturally colonized on potato. It appears probable that the cucumber mosaic virus was carried by the aphids to the potato when the insects moved to this crop in the early spring, the original source being one or another of the wild diseased perennial host plants. The cucumber mosaic infection in the potatoes certainly does no damage to that crop, and evidence to date indicates that it is present in very limited amount, altho sufficient to be readily spread to cucumbers by the migrating aphids. In the cucumber field, after the first few primary infections have occurred, the abundance of insect carriers makes possible the extremely rapid spread of the disease already noted. It is now possible to understand why no close connection between the wild host plants and mosaic infection in cucumbers on Long Island has been observed and why the disease has never been checked by locating cucumber fields far away from wild host plants. Furthermore, it may be understood how the intensive development of potato culture in this locality has favored the multiplication of aphids, and, in turn, the spread of cucumber mosaic.

We have discussed the mosaic disease as if it were caused by a single virus because under Long Island conditions this has appeared to be the case. The "elch" virus disease reported by Johnson (9) has not been observed; nor has the "Bettendorf" mosaic reported by Porter (14), which latter, on the basis of symptoms described, might be identical with the "aucuba" type of cucumber mosaic previously described by Bewley (2). The mosaic disease with which we are concerned answers in every respect to the description given by Doolittle (5) of this trouble as it occurs thru the midwest.

DOWNY MILDEW

Downy mildew (*Peronoplasmopora cubensis* (B. & C.) Clint.) is a second serious disease of cucumbers on Long Island. This disease threatened the industry with extinction in 1894. Spraying experiments in this State (17) demonstrated the practicability of control with bordeaux mixture. The disease is still a serious one and causes much loss, tho growers recognize that it is possible to prevent it by spraying.

Downy mildew or blight, as it is usually called, appears as violet colored blotches on the lower side of the leaf, while on the upper leaf surface there are yellow blotches. The older leaves near the crown of

the hill are first attacked and dry up. Afterwards the disease spreads out. This disease appears on Long Island during the latter half of August, and unprotected fields are completely killed in early September. This disease will make its appearance, and destroy the crop, even in years of extreme drought, and differs in this respect from similar troubles of other crops, such as mildew of lima beans and blight of potatoes, since these latter troubles need be feared only during wet seasons.

BACTERIAL WILT

Bacterial wilt (*Bacillus tracheiphilus* E. F. S.) is a third disease of importance. Not uncommonly 25 to 75 per cent of the plants in the field are killed by wilt before the season is over. The symptoms of wilt are so well known as hardly to need description. The first indication is the drooping of the leaves of a single branch, and later the entire plant wilts and dies. In the earlier stages of the attack, if a wilted branch is cut across, the thick white bacterial mass can be squeezed out of the severed water-conducting bundles by pressing the stem. This white exudate is very sticky and when touched with the point of a knife it "strings". This test is easily made, and a sure indication of the disease.

Rand and Enlows (15) and Doolittle (6) have shown that the bacterial wilt lives over winter in the adult cucumber beetles and that the infection is spread from plant to plant entirely by these insects. Each season the disease appears on Long Island soon after the beetles appear.

MINOR CUCUMBER DISEASES

On Long Island, powdery mildew (*Erysiphe cichoracearum* D.C.) and bacterial spot (*Bacterium lachrymans* Sm. and Bryan) are diseases of minor importance. The powdery mildew usually appears toward the end of the season and, in unsprayed fields, occasionally does some damage. The blotches of this disease are on the upper leaf surface, and they are white as if dusted with flour.

Bacterial spot has been prevalent on Long Island but one season out of the past nine. This single year, 1928, was extremely wet, and the disease did great damage. This disease is usually noticed first on the fruits. It makes numerous round, water-soaked spots which later turn whitish due to the drying on the surface of a bacterial exudate (Fig. 3). The spots are not deep, and the fruit does not usually decay,

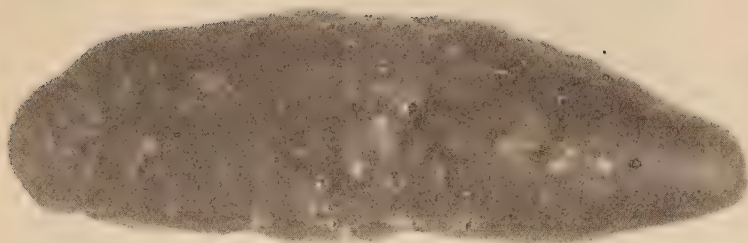


FIG. 3.—BACTERIAL SPOT ON CUCUMBER.
This disease is rarely troublesome on Long Island.

but its appearance for market is ruined. The disease attacks the leaves, and they become quite ragged looking due to the numerous irregular holes. The usual spraying gave no control of bacterial spot in the one year that this disease was present.

CONTROL MEASURES

EXPERIMENTS WITH SEED TREATMENT

There are two objectives to seed treatment, *viz.*, the destruction of disease germs either carried on the surface or within the seed, and the protection of the seed from decay by soil-borne organisms after it is planted.

Of the five diseases listed above, only the bacterial spot is carried on the seed. Treatment with mercuric chloride, 1 to 1000, for 10 minutes, followed by thoro rinsing, has been found effective in freeing cucumber seed from this infection. The writer has done no work on this owing to the rare occurrence of the disease on Long Island.

Protection of the seed against decay after it is sown is of great help for all sowings made before June 1. After this date the ground is warm enough so that there is little trouble from seed decay. Dust treatments are preferred for this purpose owing to their great convenience, and to the fact that they are less likely than liquid treatments to cause injury, or to shorten the life of the seed.

To test the value of dust seed treatments, seed of the Davis Perfect cucumber was dusted with a variety of preparations and sown May 2, 1927. Five hundred seeds were planted for each treatment. The results are shown in Table 1.

TABLE 1.—EFFECT OF DUST TREATMENTS ON THE GERMINATION OF CUCUMBER SEED, 1927.

TEST No.	DUST PREPARATION	PERCENTAGE STAND	TEST No.	DUST PREPARATION	PERCENTAGE STAND
1	Copper carbonate, 25%	21.6	18	Bayer dust	24.0
2	Copper carbonate, 50%	34.6	19	Bayer dip dust	36.4
3	Copper carbonate, 75%	33.8	20	Semesan Jr.	60.6
4	Copper chloride, 25%	63.0	21	Semesan (10% Hg)	35.6
5	Copper chloride, 50%	14.4	22	Semesan (20% Hg)	46.4
6	Copper chloride, 75%	12.8	23	Semesan (35% Hg)	36.0
7	Copper benzoate, 25%	41.8	24	Creosote,	3% 28.4
8	Copper benzoate, 50%	36.4	25	Creosote,	3% 36.0
9	Copper benzoate, 75%	18.4	26	Beta naphthol,	3% 26.8
10	Copper tartrate, 25%	40.0	27	Beta naphthol,	10% 18.2
11	Copper tartrate, 50%	38.0	28	Beta naphthol,	20% 48.6
12	Copper tartrate, 75%	31.0	29	{ Beta naphthol,	3% 38.2
13	{ Copper tartrate, 25%		{ Potassium carbonate,	3% 34.6	
	{ Potassium carbonate, 15%	30.4	{ Beta naphthol,	10% 25.4	
14	{ Copper tartrate, 50%	42.8	{ Potassium carbonate,	10% 32.4	
15	{ Potassium carbonate, 25%	35.2	{ Beta naphthol,	20% 38.0	
16	Copper acetate, 25%	46.0	{ Potassium carbonate,	20% 40.0	
17	Copper acetate, 50%	22.6	Iodoform,	0.5% 40.0	
	Copper acetate, 75%		Iodoform,	2.0% 40.0	
Check	None	32.0	Iodoform,	5.0% 40.0	
Check	None	31.2	Iodoform,	10.0%	
Check	None	43.0			
Check	None	34.4	Check	33.8	
Check	None	24.8	Check	32.8	
			Check	36.2	
			Check	45.4	

Careful inspection of the plats, coupled with the actual percentage stand records, indicate that Semesan Jr. and copper chloride, 25 per cent. were best. Consequently, further comparisons were made with these two. The variety was again Davis Perfect, and lots of 500 seeds each were used. The results are given in Table 2.

TABLE 2.—EFFECT OF DUST TREATMENTS ON THE GERMINATION OF CUCUMBER SEED, 1928.

DUST PREPARATION	PERCENTAGE STAND		
	Plat 1	Plat 2	Average
Copper chloride, 20%	80.1	78.4	79.3
Copper chloride, 25%	83.0	84.4	83.7
Copper chloride, 30%	80.1	80.0	80.0
Semesan Jr.	84.6	80.0	82.3
Check, untreated	64.6	64.0	64.3

A second test was made in 1928 with the results shown in Table 3.

TABLE 3.—EFFECT OF DUST TREATMENTS ON THE GERMINATION OF CUCUMBER SEED, 1928.

DUST PREPARATION	PERCENTAGE STAND			
	Plat 1	Plat 2	Plat 3	Average
Copper chloride, 25%	76.8	71.4	74.8	74.3
Semesan Jr.	78.0	77.4	81.4	78.9
Check, untreated	78.2	68.8	76.4	74.5

A final experiment was made in 1929, the results of which are given in Table 4.

TABLE 4.—EFFECT OF DUST TREATMENT ON THE GERMINATION OF CUCUMBER SEED, 1929.

DUST PREPARATION	PERCENTAGE STAND				
	Plat 1	Plat 2	Plat 3	Plat 4	Average
Copper chloride, 25%	10.0	32.2	24.4	39.0	26.4
Semesan Jr.	22.4	45.8	7.6	37.0	28.2
Check, untreated	14.0	24.0	7.0	26.0	17.8

The copper chloride dust used in these experiments was diluted in talc. It was a very good preparation mechanically, and has undoubted merit as a treatment for cucumber seed. The results secured with it, however, were not quite as good as those secured with Semesan Jr., hence the latter is to be preferred.

Van Haltern (18) reports that he had some injury from Semesan Jr.; but in repeated tests of this material in which the treated seed was actually planted in soil, we have never had the slightest injury, and furthermore the seed treated with Semesan Jr. and stored two years before planting has shown only beneficial effects from the treatment. It is believed that the treatment is perfectly safe.

SPRAYING EXPERIMENTS

Cucumber spraying can be divided into two operations, *viz.*, early spraying, and mid- and late-season spraying. Early spraying is aimed directly against the cucumber beetle and indirectly against the wilt disease. The practical means of controlling wilt has proved to be protection of the plants against the beetles, because these insects are apparently the sole means by which this disease is spread. In a previous publication (3) it was shown that while one or two applications of spray or dust were sufficient to prevent excessive damage by the actual feeding of the cucumber beetles, four to seven applications, depending on season and material applied, were required to control satisfactorily the wilt disease. Since the plants are small at this season, the time and material required to cover them is not excessive, and the results obtained are well worth the slight expense. Thoro early spraying has frequently been suggested as a protection against mosaic disease, but, while our results showed some benefit, the degree of protection was slight, and the disease spread so rapidly that the gain was soon of no consequence. In comparisons of 2-4-50 bordeaux with mixtures containing more copper, it was found that the vines sprayed with the stronger copper mixtures were stunted and the yield from them was much reduced. The calcium arsenate-gypsum dust, 1 to 15, mixture gave good results.

The results of these experiments emphasized the importance of plant injury from the early use of bordeaux mixture of strengths that are usually recommended for cucumber spraying. Others have made similar observations. Thus, Hockett (8) says, "Plants were retarded in growth by frequent and thoro applications of bordeaux mixture and nicotine dust during early growth." To check this question of the strength of bordeaux mixture that is safe to use on young plants, and how important copper sprays are for the control of wilt, the following experiment was conducted in 1929.

Seed of the Woodruff Hybrid variety was planted on May 19. The rows were cut into plats 65 feet long, and thinned to a uniform

stand of plants. The season was dry, and the beetles were numerous and active over a long period. Applications of spray and dust were made on June 1, 7, 14, 18, 25, and 28. Wilted plants were removed as counted. The first were pulled out July 2, and the last on July 27. The records are shown in Table 5.

TABLE 5.—EFFECT OF SPRAY AND DUST TREATMENTS ON THE CONTROL OF CUCUMBER WILT IN 1930.

SPRAY OR DUST MATERIAL*	TOTAL NUMBER OF PLANTS KILLED BY WILT				NUMBER OF CUCUMBERS FROM FIRST PICKING			
	Series 1	Series 2	Series 3	Total	Series 1	Series 2	Series 3	Total
20-25-55 dust 1	5	5	3	13	3	7	1	11
1-15 dust 2	33	18	23	74	8	6	3	17
4-6-1-50 spray 1	6	5	5	16	0	0	0	0
3-3-50 spray 2	6	7	8	21	26	22	7	55
1½-3-1-50 spray 3	6	7	7	20	1	9	5	15
Check, untreated	52	42	45	139	4	1	0	5
Check, untreated	46	41	42	129	1	1	0	2

*The formulae of the dusts and sprays were as follows: Dust 1—20% monohydrated copper sulfate, 25% calcium arsenate, 55% hydrated lime; Dust 2—1 part calcium arsenate, 15 parts gypsum; Spray 1—4 lbs. copper sulfate, 6 lbs. hydrated lime, 1 lb. calcium arsenate, 50 gal. water; Spray 2—3 lbs. kayso, 3 lbs. calcium arsenate, 50 gal. water; Spray 3—1½ lbs. copper sulfate, 3 lbs. hydrated lime, 1 lb. calcium arsenate, 50 gal. water.

Thruout the experiment the superiority of the kayso-calcium arsenate spray was evident. Of the two bordeaux sprays, the weaker was the better, but both caused noticeable plant stunting, and this was so severe with the 4-6-50 formula that not a single cucumber was harvested in the first picking from any of the plats so treated. Figs. 4 and 5 show the comparative growth of bordeaux and kayso-calcium arsenate sprayed plats. Of the two dusts, while both gave good beetle control, the copper dust was much the more effective in controlling wilt.

It was conclusively demonstrated by the 1929 experiment that even the weakest bordeaux mixture may cause severe injury when used in the early cucumber sprays, and, since the kayso-calcium arsenate combination was highly effective in controlling beetles and wilt disease and has never caused plant injury, this combination is to be preferred. A mixture containing 1½ pounds instead of 3 pounds of kayso has been tried with apparently equally good results.

In 1930 a comparison was made between this spray and the copper-calcium arsenate-lime dust. Wilt was not severe enough in 1930 to be a factor, and no results were secured as to the control of this disease.



FIG. 4.—SPRAYING CUCUMBERS FOR WILT CONTROL.

This plat was sprayed early with a mixture containing 3 pounds each of calcium arsenate and calcium caseinate in 50 gallons of water. Note the vigorous growth of the vines.



FIG. 5.—SPRAYING CUCUMBERS FOR WILT CONTROL.

This plat was adjacent to that shown in Fig. 4, but it was sprayed with bordeaux mixture, 4-6-50 (1 per cent). Note the weak growth.

However, the plants were severely attacked by thrips, and these pests did far more damage in the dusted plats than in the sprayed. For some reason the copper dust favored this development of thrips.

Mid- and late-season spraying has for its object the protection of the plants against the blight or mildew disease. The problem of controlling blight by spraying is still serious, tho no one questions but that it can be done. The usual recommendations, however, are not followed by the most successful Long Island cucumber growers. During some periods, they spray as often as every other day. They use very strong bordeaux late in the season, and it is certainly true that, whereas the young vines are readily injured by bordeaux, the old ones are tough and resistant to injury. The entire question of spraying for blight should be thoroly investigated with relation to the best spacing of rows, timing of sprays, strength of sprays, etc. The writer has done much preliminary work but has not yet gone thoroly into this phase of the cucumber disease problem.

For the present, it is recommended that with the crop planted about June 1, growers begin spraying for blight the last of July and, using three overhead nozzles per row, make semi-weekly applications. The first three applications should be made with 3-4-50 bordeaux, and after that 6-8-50 bordeaux should be used. It will usually be necessary to continue spraying thru September, but after the vines are well protected and growth is no longer active applications may be less frequent.

BREEDING EXPERIMENTS

Mosaic—Thru inbreeding it has been possible to isolate from common varieties strains that are very much more resistant to mosaic disease than are the parent varieties. Furthermore, a number of foreign varieties have been found which show resistance varying from moderate to very high. No variety or strain has shown complete immunity to the disease, but the resistance of some is such that they recover completely from the disease following infection, while others that continue to show symptoms to a slight degree are but little damaged and mature good crops. With the material in hand, the production of mosaic-resistant varieties of both slicing and pickling types is being rapidly pushed with every prospect of success.

Wilt—Strains have been secured both of the slicing and pickling types that show marked resistance to this disease. All of the common pickling varieties now in use are highly susceptible to wilt, and the control of this disease will be made very much easier by the develop-

ment of more resistant sorts; especially under the conditions which exist on Long Island where the abundance of cucumber beetles makes wilt a serious problem. None of the foreign varieties of cucumbers tested have shown wilt resistance, in fact many of these have displayed extreme susceptibility.

Downy mildew or blight—No strain or variety has been found that shows any degree of resistance to this disease, hence spraying alone can be depended on for its control.

SUMMARY

The most serious diseases attacking cucumbers on Long Island are mosaic, wilt, and blight or downy mildew.

None of these are seed borne, but dusting seed with the organic mercurial, Semesan Jr., was of value when seed was sown before the ground was thoroly warm. Under these conditions the dust protected the seed against decay and improved the stand.

Spraying investigations showed that thoro protection of the young plants against the cucumber beetles also protected them against the wilt disease. Dust preparations, such as gypsum 15 parts and calcium arsenate 1 part, gave fairly good wilt protection; but better results were secured by spraying with kayso 3 pounds, calcium arsenate 3 pounds, and water 50 gallons. The use of bordeaux mixture sprays on the young plants stunted them and reduced the early yield.

Spraying for blight disease should begin the last of July. A bordeaux mixture of the 3-4-50 formula should be used for the first three applications and after that, a 6-8-50 formula. Applications should be made twice a week, as a rule, and three nozzles should be used to the row.

Mosaic, which is the most serious disease problem and the chief cause for the decline of the cucumber crop on Long Island, was not controlled by spraying. Eradication of wild host plants, which has given successful control of mosaic in some localities, has failed to control the disease on Long Island because of local conditions which are very favorable to the spread of the trouble. Resistant varieties offer the only possibility of control.

Thru inbreeding, it has been possible to isolate strains from native varieties of cucumbers which possess distinctly greater mosaic resistance than the parent varieties. Tests with foreign varieties have resulted in the discovery of a number of these which are mosaic-resistant. At the present time an effort is being made to secure the proper combination of mosaic resistance with desirable type.

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